~~30~~ 31. (New) A process for producing crystalline HNF, comprising:
preparing a crystallising mixture of raw HNF and methanol;
subjecting the crystallising mixture to ultrasonic vibration having a frequency of between 10 and 100 kHz and an amplitude of between 0.4 and 30 μm during crystallization; and
harvesting crystalline HNF after crystallization,
wherein the ultrasonic vibration results in a zone of ultrasonic vibration in the crystallising mixture, wherein the crystallising mixture is stirred during crystallization and is passing through the zone of ultrasonic vibration continuously, and wherein the crystalline HNF has increased thermal stability and decreased sensitivity with respect to the raw HNF.

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~~31~~ 32. (New) The process of claim ~~30~~ 31, where the crystallization is carried out at a temperature between 0°C and 100°C.

~~32~~ 33. (New) The process of claim ~~31~~ 32, where the crystallization is carried out at a temperature between 15°C and 75°C.

Concl.

Please cancel claims 1, 2, 9-12, 14-16, 18, 20, 21, 23, 25 and 26.

REMARKS

In response to the Office Action mailed August 13, 2002, Applicants have amended the above-identified application. In particular, Applicants have added new claims 27-32 and canceled Claims 1, 2, 9-12, 14-16, 18, 20, 21, 23, 25 and 26. No new matter has been introduced. Claims 27-32 are pending. Reconsideration and allowance of all pending claims are respectfully requested.

Rejections under 35 U.S.C. 103(a)

Claims 1, 2, 9-12, 14-16, 18, 20, 21, 23, 25 and 26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,833,891 to Subramaniam et al. ("Subramaniam") in view of U.S. Patent No. 3,954,526 to Mangum et al.("Mangum"), U.S. Patent No. 5,020,731 to Somoza et al. ("Somoza I"), and U.S. Patent No. 5,279,492 to Somoza et al. ("Somoza II") for reasons stated on page 2-4 of the outstanding Office Action.

The present invention discloses a process for preparing a crystalline energetic material with increased thermal stability and decreased sensitivity by continuously passing a crystallizing mixture of the energetic material through a zone of ultrasonic vibration during crystallization. The zone of ultrasonic vibration is created by an ultrasonic vibration having a frequency of between 10 and 100 kHz and an amplitude of between 0.4 and 30 μm.

The Office Action alleges that Subramaniam, Mangum, Somoza I and Somoza II teach particle precipitation in the presence of ultrasonic waves for making small size crystals of explosive ingredients. The Examiner further alleges that "it is perfectly clear that these processes will produce a beneficial product with small size, improved purity and reduced sensitivity" and thus held that the present invention is obvious over the cited references. Applicants respectfully traverse the 103 rejection.

First, the cited references are contradictory to each other with regard to the relationship between particle size and the reactivity/sensitivity of energetic materials. While Somoza II describes that some explosive materials exhibit a decrease in sensitivity when the particle size is reduced below some threshold values (col 1, lines 21-63), Subramaniam discloses that reducing particle size by the precipitation method described therein improves reactivity of explosives (col. 17, line 56). Therefore, based on the teaching from the cited references, it is not clear whether the particle size is inversely related to the stability. According to the present invention, there is no direct correlation between particle morphology (aspect ratio and particle size are both morphology parameters) and the thermal stability/sensitivity (page 3, lines 19-28). It is the claimed crystallisation process, as a whole, that provides the desired features of the crystalline energetic materials.

Furthermore, to establish a *prima facie* case of obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 165 USPQ 494, 496 (CCPA 1970). None of the cited references discloses or suggests that ultrasonic vibration during crystallization improves the thermal stability of the crystalline energetic material, nor does any cited reference disclose or suggest the range of amplitude of ultrasonic vibration claimed in the present invention. As such, Applicants respectfully submit that all the claim limitations are not taught or suggested by the cited references.

With regard to the combination of references, "the references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination..." MPEP §2141. Applicants respectfully submit that Subramaniam, Magnum and Somoza I do not suggest using ultrasound vibration in a crystallisation process to increase the thermal stability and decrease the sensitivity of crystalline energy materials. Applicants further submit that Somoza II only suggests a correlation between particle size and sensitivity. None of the references mentions the concept of thermal stability and the desire to improve such stability by crystallization, nor does any reference suggest the desirability to optimize the amplitude of ultrasonic wave. Therefore, considered as a whole, these references do not suggest the desirability and thus the obviousness of making the combination to address the thermal stability issue using ultrasonic vibration of certain amplitudes during crystallisation.

The Office Action alleges that "variation or well known parameters would have been obvious for the expected reasons taught in the references." However, the cited references only

teach methods of reducing particle sizes using ultrasonic vibration, they provide no suggestion, guidance or motivation with regard to improving thermal stability using ultrasonic vibration of certain amplitudes.

The Office Action further alleges that "as to the allegations regarding improved properties, where the product appears to be the same or only slightly different, the properties recited would appear to be **inherent**, regardless of the method of preparation. It must be pointed out that the frequencies and the precipitation of energetic materials is taught. Thus, the same results must be obtained." Applicants respectfully disagree. The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) (reversed rejection because inherency was based on what would result due to optimization of conditions, not what was necessarily present in the prior art); *In re Oelrich*, 212 USPQ 323, 326 (CCPA 1981). "To establish inherency, the extrinsic evidence `must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.

In relying upon the theory of inherency, the Office Action must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990). It is well known to one skilled in the art that ultrasound waves are mechanical pressure waves, and that frequency and amplitude are two unrelated characteristics of pressure waves. The frequency of a pressure wave is defined as the number of high/low pressure regions crossing a point per unit time. The amplitude of a pressure wave is the difference between the pressure at compression and the ambient pressure. . While the cited references disclose a range of frequencies for the precipitation of energetic materials, none of them mentions the optimal range of amplitude. It cannot be said that the amplitude range taught by the present invention is necessarily present in the thing described in the references, and that the amplitude range would be so recognized by persons of ordinary skill.

Moreover, the references teach precipitation of energetic materials in various special settings. Subramaniam teaches precipitation in near- or supercritical fluid conditions. Mangum describes precipitation in a volatile liquid with a second less volatile liquid which is miscible with the first liquid and is a non-solvent for the energetic material. Somoza, on the other hand, teaches an ultrasonic grinding step, which is a process completely different from the claimed process of crystallisation. When applying ultrasonic vibration during grinding, the ultrasonic energy is directed towards the solid particulates which apparently breaks under influence of the ultrasonic energy. When applying ultrasonic vibration during crystallisation, the ultrasonic energy is directed towards the crystallizing mixture where it influences nucleation and crystal growth of the solid particulates. The present invention, on the contrary, only requires a crystallization of a energetic material in a solvent, such as methanol. The Office Action thus fails to provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic (i.e., reduced sensitivity and increased thermal stability)

necessarily flows from the teachings of the applied prior art. As recited in MPEP §2112, "inherency..., may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *In re Robertson*, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999).

Claims 1, 2, 9-12, 14-16, 18, 20, 21, 23, 25 and 26 stand rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Markels et al. for reasons stated on page 4 of the outstanding Office Action.

Markels describes a process for producing finely divided rounded particles by precipitating a solute out of solution while simultaneously subjecting the solution to both mechanical agitation and high frequency acoustic vibration. Markels teaches that the frequency of the vibrations can vary from the high audio type to the ultrasonic type, i.e., from about 10 to about 150 kHz. Markels does not disclose or suggest the amplitude of the ultrasonic vibration, nor does it mention the thermal stability and sensitivity of the product prepared by the claimed process. Markels provides no motivation to optimize amplitude of the ultrasonic vibration to improve the thermal stability and sensitivity of crystalline energetic material. Nor can it be said that the increased thermal stability and decreased sensitivity are inherent to the products prepared by the Markels' process, because the thermal stability and sensitivity, as demonstrated by the examples in the present application, are clearly related to the amplitude of the ultrasonic wave. Without disclosing the range of amplitude, it does not necessarily flows from the teachings Markels that energetic material particles produced by the method possess the improved thermal stability and sensitivity as claimed in the present invention.

Rejections under 35 U.S.C. 112

Claims 1, 2, 9-12, 14-16, 18, 20, 21, 23, 25 and 26 stand rejected under 35 U.S.C. 112, first paragraph, for reasons stated on pages 4 and 5 of the outstanding Office Action. Specifically, the Office Action alleges that "the examples appears to deal solely with HNF. From a consideration of Zee et al.,... it may appear that HNF is an atypical energetic material..."

Applicants respectfully traverse the rejection. First, a careful inspection of the Zee reference does not reveal any indication that HNF is atypical with regard to its behavior or characteristics during crystallization. Zee describes the tendency to "gas" which is attributed to impurities of the HNF and appears to be "unique" for HNF. However, the "gassing" problem is irrelevant to the improved thermal stability and sensitivity of the present invention. As known to one skilled in the art, high purity HNF may be obtained by recrystallisation without ultrasonic vibration.

Furthermore, the presence of only one working example should never be the sole reason for rejection claims as being broader than the enabling disclosure... To make a valid rejection, one must evaluate all the facts and evidence and state why one would not expect to be able to extrapolate that one example across the entire scope of the claims" MPEP §2164.02. The present

invention claims a method for improving thermal stability and sensitivity of a group of energetic materials that are all produced in a manner wherein at some time during their preparation a crystallization step occurs. Because the final product form of these materials is crystalline, one of the final steps of the preparation process must include crystallization. As such, one would expect that the method of crystallization with ultrasonic vibration can be used for any of these materials.

In view of the foregoing remarks, favorable reconsideration of the pending claims is requested. Applicants respectfully submit that this application is in condition for allowance and request that a notice of allowance be issued. Should the Examiner believe that a conference would expedite the prosecution of this application or further clarify the issues, the Examiner is encouraged to contact Applicants' attorney at the telephone number listed below.

Respectfully submitted,

Dated: September 27, 2002

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PENDING CLAIMS

27. (New) A process for producing a crystalline energetic material, comprising:
preparing a crystallising mixture comprising a solvent and a raw energetic material selected from the group consisting of HNF, CL-20, ADN, AP, RDX, HMX and PETN;
subjecting the crystallising mixture to ultrasonic vibration having a frequency of between 10 and 100 kHz and an amplitude of between 0.4 and 30 μm during crystallization; and
harvesting a crystalline energetic material after the crystallization,
wherein the ultrasonic vibration results in a zone of ultrasonic vibration in the crystallising mixture, wherein the crystallising mixture is stirred during crystallization and is passing through the zone of ultrasonic vibration continuously, and wherein the crystalline energetic material has increased thermal stability and decreased sensitivity with respect to the raw energetic material.

28. (New) The process of claim 27, where the crystallization is carried out at a temperature between 0°C and 100°C.

29. (New) The process of claim 28, where the crystallization is carried out at a temperature between 15°C and 75°C.

30. (New) A process for producing crystalline HNF, comprising:
preparing a crystallising mixture of raw HNF and methanol;
subjecting the crystallising mixture to ultrasonic vibration having a frequency of between 10 and 100 kHz and an amplitude of between 0.4 and 30 μm during crystallization; and
harvesting crystalline HNF after crystallization,
wherein the ultrasonic vibration results in a zone of ultrasonic vibration in the crystallising mixture, wherein the crystallising mixture is stirred during crystallization and is passing through the zone of ultrasonic vibration continuously, and wherein the crystalline HNF has increased thermal stability and decreased sensitivity with respect to the raw HNF.

31. (New) The process of claim 30, where the crystallization is carried out at a temperature between 0°C and 100°C.

32. (New) The process of claim 31, where the crystallization is carried out at a temperature between 15°C and 75°C.